

WE CLAIM:

1. A transformer comprising:

a core comprising two marginal portions each having two ends, a central portion having two ends and located in spaced relation between the two marginal portions and connecting portions interconnecting both ends of the central portion with corresponding ends of the two marginal portions;

at least one first primary winding and at least one first secondary winding wound around one of the two marginal portions; and

at least one second primary winding and at least one second secondary winding wound around the other of the two marginal portions;

wherein the central portion is adapted to provide a shunt for components of the magnetic field produced by electric current in the windings.

2. A transformer according to claim **1** wherein the at least one first primary winding comprises two first primary windings, the at least one first secondary winding comprises one first secondary winding, the at least one second primary winding comprises two second primary windings and the at least one second secondary winding comprises one second secondary winding.

3. A transformer according to claim **2** wherein:

the turn ratio of either of the two first primary windings to the first secondary winding is 1:1; and

the turn ratio of either of the two second primary windings to the second secondary winding is 1:1.

4. A transformer according to claim **2** further comprising

means for connecting the two first primary windings to TIP and RING leads of a combined plain old telephone services (POTS) and any type of digital subscriber loop (xDSL) services and to a capacitor whereby the two first primary windings and the capacitor form a high pass filter (HPF);

means for connecting the first secondary winding to an xDSL circuit;

means for connecting the two first primary windings to one side of a low pass filter (LPF);

means for connecting the two second primary windings to another side of the LPF; and

means for connecting the second secondary winding to a POTS circuit.

5. A transformer according to claim **1** wherein the cross-sectional area of the central portion, in relation to the dimensions of the marginal and connecting portions, is specified to regulate the extent to which components of the magnetic field produced by electric currents in the windings are shunted through the central portion,

whereby the strength of the magnetic coupling between any one of the first primary and secondary windings and any one of the second primary and secondary windings is tuned by the extent to which the components of the magnetic field are shunted through the central portion.

6. A transformer according to claim **1** wherein the core portions are rectangular parallelepipeds.

7. A transformer according to claim **6** wherein:

the approximate width, height and depth of the central portion is 12 mm, 12 mm and 6 mm, respectively;

the approximate width, height and depth of the marginal portions is 1.5 mm, 12 mm and 6 mm, respectively; and

5 the approximate width, height and depth of the connecting portions is 3 mm, 1.5 mm and 6 mm, respectively.

8. A transformer according to claim **7** wherein the magnetic coupling between any one of the first windings and any one of the second windings is in the range 0.01 to 0.25.

10 9. A transformer according to claim **7** wherein the magnetic coupling between any two first windings is in the range 0.9 to 0.9999 and the magnetic coupling between any two second windings is in the range 0.9 to 0.9999.

10. A transformer according to claim **1** further comprising
15 a first air gap inserted across the one marginal portion between the first primary and secondary windings.

11. A transformer according to claim **10** wherein the first air gap is approximately 0.1 mm in width.

12. A transformer according to claim **1** further comprising
20 a second air gap inserted across the other marginal portion between the second primary and secondary windings.

13. A transformer according to claim **12** wherein the second air gap is approximately 0.1 mm in width.

14. A transformer for combined POTS and xDSL service
25 comprising:

a core comprising two marginal portions each having two ends, a central portion having two ends and located in

spaced relation between the two marginal portions and connecting portions interconnecting both ends of the central portion with corresponding ends of the two marginal portions;

two first primary windings and at least one first
5 secondary winding wound around one of the two core marginal portions;

two second primary windings and at least one second
secondary winding wound around the other of the core marginal
portions terminals for connecting the two first primary
10 windings to TIP and RING and to a capacitor whereby the two
first primary windings and the capacitor form a high pass
filter (HPF);

terminals for connecting the first secondary winding
to any type of digital subscriber loop (xDSL) circuit;

15 terminals for connecting the two first primary
windings to one side of a low pass filter (LPF);

terminals for connecting the two second primary
windings to another side of the LPF; and

terminals for connecting the second secondary winding
20 to a plain old telephone service (POTS) circuit;

wherein the central portion of the core serves as a
shunt to ensure only a very weak magnetic coupling between any
one of the first windings and any one of the second windings
relative to the magnetic coupling between any two first
25 windings or any two second windings.

15. A transformer according to claim **14** wherein the
magnetic coupling coefficient between any one of the first
windings and any one of the second windings is in the range

0.01 to 0.25 and the magnetic coupling coefficient between any two first windings and between any two second windings is in the range 0.9 to 0.9999.

16. A transformer according to claim **14** further

5 comprising a first air gap provided in the one marginal portion between the first primary windings and the first secondary winding and a second air gap provided in the other marginal portion between the second primary windings and the second secondary winding.

10 17. A transformer according to claim **15** further

comprising a first air gap provided in the one marginal portion between the first primary windings and the first secondary winding and a second air gap provided in the other marginal portion between the second primary windings and the second
15 secondary winding.

18. A transformer according to claim **14** wherein the core is rectangular in cross-section with two rectangular holes extending therethrough to define the central, marginal and connecting portions of the core as parallelepipeds.